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EXAMINER	
KREINER, MICHAEL B	
ART UNIT	PAPER NUMBER
4174	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/595,621	DEFENDINI ET AL.	
	Examiner	Art Unit	
	Michael Kreiner	4174	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8* is/are pending in the application.

4a) Of the above claim(s) *5-8* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/19/2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

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DETAILED ACTION

Specification

1. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

2. The abstract of the disclosure is objected to because it is more than 150 words.

Correction is required. See MPEP § 608.01(b).

3. The specification must be organized into headings, as explained below.

The following guidelines illustrate the preferred layout for the specification of a utility application. These guidelines are suggested for the applicant's use.

Arrangement of the Specification

As provided in 37 CFR 1.77(b), the specification of a utility application should include the following sections in order. Each of the lettered items should appear in upper case, without underlining or bold type, as a section heading. If no text follows the section heading, the phrase "Not Applicable" should follow the section heading:

(a) TITLE OF THE INVENTION.
(b) CROSS-REFERENCE TO RELATED APPLICATIONS.
(c) STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT.
(d) THE NAMES OF THE PARTIES TO A JOINT RESEARCH AGREEMENT.
(e) INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC.
(f) BACKGROUND OF THE INVENTION.
(1) Field of the Invention.

(2) Description of Related Art including information disclosed under 37 CFR 1.97 and 1.98.
(g) BRIEF SUMMARY OF THE INVENTION.
(h) BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S).
(i) DETAILED DESCRIPTION OF THE INVENTION.
(j) CLAIM OR CLAIMS (commencing on a separate sheet).
(k) ABSTRACT OF THE DISCLOSURE (commencing on a separate sheet).
(l) SEQUENCE LISTING (See MPEP § 2424 and 37 CFR 1.821-1.825. A "Sequence Listing" is required on paper if the application discloses a nucleotide or amino acid sequence as defined in 37 CFR 1.821(a) and if the required "Sequence Listing" is not submitted as an electronic document on compact disc).

Claim Objections

1. Claims 5-8 are objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim cannot depend from any other multiple dependent claim. See MPEP § 608.01(n). Accordingly, the claims have not been further treated on the merits.

2. Claim 1 is objected to because of the following informalities: line 21 "α is different from 0° and 180°" is unclear, as opposed to "α does not equal 0° or 180°." Appropriate correction is required.

3. Claim 3 is objected to because of the following informalities: line 3 "used as secondary actuator" should read "used as a secondary actuator." Appropriate correction is required.

4. Claim 1 is a method claim that does not positively recite method steps. For example, page 2 line 9, which recites "control commands are calculated" should read "calculating control commands" in order to properly set forth the method.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. See MPEP § 2173.05(c). Note the explanation given by the Board of Patent Appeals and Interferences in *Ex parte Wu*, 10 USPQ2d 2031, 2033 (Bd. Pat. App. & Inter. 1989), as to where broad language is followed by "such as" and then narrow language. The Board stated that this can render a claim indefinite by raising a question or doubt as to whether the feature introduced by such language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims. Note also, for example, the decisions of *Ex parte Steigewald*, 131 USPQ 74 (Bd. App. 1961); *Ex parte Hall*, 83 USPQ 38 (Bd. App. 1948); and *Ex parte Hasche*, 86 USPQ 481 (Bd. App. 1949). In the present instance, claim 1 recites:

the broad recitation "the kinematic and dynamic variables, which are necessary for controlling the attitude of the satellite", and the claim also recites "the attitude angles and angular velocities of the satellite along the three axes" which is the narrower statement of the range/limitation;

the broad recitation "setpoint variables, intended to allow objectives assigned to the satellite attitude control system to be achieved", and the claim also recites "the tilting and pointing along at least one of the three axes of the (X, Y, Z) coordinate system" which is the narrower statement of the range/limitation;

the broad recitation "commands intended to vary the orientation of their gimbal axes", and the claim also recites "gimbal angular position setpoints that have to be generated by a local position feedback control, or electric current setpoints, for currents that have to be injected into motors for orienting the gimbal axes" which is the narrower statement of the range/limitation.

The phrase "preferably being chosen to be small enough not to create an excessively large internal angular momentum on board the satellite but large enough to ensure controllability of the attitude control system along the three axes (X, Y, Z) without necessarily having to modify the rotation speed of the rotor of at least one of the control moment gyros" (lines 29-35) does not clearly set forth the metes and bounds of the patent protection desired, and therefore is not given any patentable weight.

Claim Rejections - 35 USC § 103

6. Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Heiberg (U.S. Pat. No. 6,241,194) in view of Bockman et al. (U.S. Pat. No. 6,360,996).

Regarding claim 1, Heiberg teaches a method for controlling the attitude of a satellite equipped with an attitude control system in a reference coordinate system (X, Y, Z) for positioning the satellite, and comprising at least three actuators called main actuators, two of which are control moment gyros (60 in fig. 2) each having a rotor (78, 80 in fig. 2) driven so as to rotate about a fixed rotation axis with respect to a steerable gimbal that can be oriented about a gimbal axis perpendicular to the rotation axis of the corresponding rotor, and stationary with respect to the satellite, characterized in that: the gimbal axes of the two control moment gyros are fixed so that these gimbal axes are parallel to each other and to the Z axis (col. 3 lines 13-15), the angular momentum

vectors (H1, H2) (74 and 76 in figs. 2 and 3a-c) of the control moment gyros therefore moving in the (X, Y) plane and making between them an angle (α) which, by definition, corresponds to a skew ε = 180 - α between the angular momentum vectors (H1, H2) (74 and 76 in figs. 2 and 3a-c) when α is different from 0° and 180° (col. 3 lines 39-42); in addition to the two control moment gyros, at least a third main actuator (38 in fig. 2) is used as a complement, delivering torques in both senses in at least one direction not lying in the (X, Y) plane, so that this third main actuator is called the Z-axis main actuator (col. 3 lines 1-11); a nonzero skew angle (ε) between the angular momentum vectors (H1, H2) (74 and 76 in figs. 2 and 3a-c) of the control moment gyros is imparted (col. 3 lines 39-42), said skew angle (ε) preferably being chosen to be small enough not to create an excessively large internal angular momentum on board the satellite but large enough to ensure controllability of the attitude control system along the three axes (X, Y, Z) without necessarily having to modify the rotation speed of the rotor of at least one of the control moment gyros;

Heiberg's invention necessitates a control system to steer the satellite, however the reference fails to teach the kinematic and dynamic variables, which are necessary for controlling the attitude of the satellite, such as for example the attitude angles and angular velocities of the satellite along the three axes, are estimated from measurements provided by sensors used on board the satellite; setpoint variables, intended to allow objectives assigned to the satellite attitude control system to be achieved, such as for example the tilting and pointing along at least one of the three axes of the (X, Y, Z) coordinate system, are calculated; and control commands are calculated, from differences between said estimated variables and said setpoint variables, and then sent

to the main actuators, these control commands being intended to control the change in said differences over time, said control commands transmitted to the control moment gyros comprising at least commands intended to vary the orientation of their gimbal axes, such as for example gimbal angular position setpoints that have to be generated by a local position feedback control, or electric current setpoints, for currents that have to be injected into motors for orienting the gimbal axes.

Bockman teaches the kinematic and dynamic variables, which are necessary for controlling the attitude of the satellite, such as for example the attitude angles and angular velocities of the satellite along the three axes, are estimated from measurements provided by sensors used on board the satellite (204 in fig. 5); setpoint variables, intended to allow objectives assigned to the satellite attitude control system to be achieved, such as for example the tilting and pointing along at least one of the three axes of the (X, Y, Z) coordinate system, are calculated (202 in fig. 5); and control commands are calculated, from differences between said estimated variables and said setpoint variables, and then sent to the main actuators, these control commands being intended to control the change in said differences over time (208 in fig. 5), said control commands transmitted to the control moment gyros comprising at least commands intended to vary the orientation of their gimbal axes, such as for example gimbal angular position setpoints that have to be generated by a local position feedback control, or electric current setpoints, for currents that have to be injected into motors for orienting the gimbal axes (210 in fig. 5). (col. 7 line 64 through col. 8 line 38).

It would have been obvious to one skilled in the art at the time of the invention to control the satellite actuators with such a control system. The actuators need a control

system to steer the satellite, and although such a system was not disclosed in Heiberg's reference, the control system disclosed by Bockman is a reasonable approximation of the very control system needed to steer Heiberg's satellite.

Regarding claim 2, Heiberg teaches the control method as claimed in claim 1, characterized in that, during an initialization phase of the attitude control system, the angle (α) between the angular momentum vectors (H1, H2) (74 and 76 in figs. 2 and 3a-c) of the two control moment gyros is brought to a value substantially different from 180°, using at least one secondary actuator on board the satellite (62 and 78), for the purpose of substantially and cumulatively modifying the angular momentum of said satellite in at least one direction in the (X, Y) plane and/or optionally the Z-axis main actuator in the case in which the latter is used to generate an angular momentum component in the (X, Y) plane (col. 3 lines 39-51).

Regarding claim 3, Heiberg teaches the control method as claimed in claim 2, characterized in that at least one of the following members is used as secondary actuator: magnetic-torquers, jet actuators, torque actuators of any other type, these preferably being selected from those of said aforementioned members necessarily used on board the satellite for carrying out operations other than the normal mode of operation of the satellite (38 in fig. 2, col. 3 lines 1-12).

Regarding claim 4, the attitude control method as claimed in either of claims 2 and 3 (both of which are covered in this rejection), characterized in that at least, one actuator (62 and 78) is used to generate torques along one, two or three axes of the reference coordinate system, the effect of which together with the satellite attitude control system is, simultaneously or sequentially, to modify the angle (α) between the

angular momentum vectors (HI and H2) (74 and 76 in figs. 2 and 3a-c) of the control moment gyros so that said angle (α) remains within a specified range (col. 3 lines 39-43), and/or in that, simultaneously, or sequentially, said Z-axis main actuator can also be desaturated, especially when said Z-axis main actuator comprises at least one reaction wheel whose angular momentum must remain, in terms of modulus, below a given limit (col. 3 lines col. 3 lines 48-51).

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Rosmann et al. (U.S. Pat. No. 5,681,012) discloses a pair of CMGs whose spin axes are parallel. The Rosmann patent describes the control system used to steer the satellite. A third actuator, such as a rotation wheel, could be combined with this reference to provide steering outside of the CMG pair's rotation plane. This outcome would provide predictable results based on vector addition—a concept well understood in physics—for the rotation vectors.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Kreiner whose telephone number is (571)270-5379. The examiner can normally be reached on Monday-Thursday 7:30am-5:00pm (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kimberly D. Nguyen can be reached on (571)272-2402. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. K./
Examiner, Art Unit 4174

/Kimberly D Nguyen/
Supervisory Patent Examiner, Art Unit 4174